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(71)Applicant : **CANON INC**

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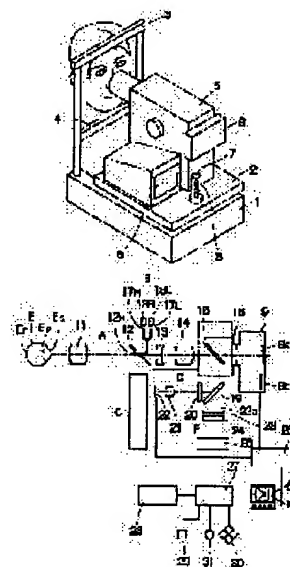
(72)Inventor : **MATSUMOTO KAZUHIRO**

## (54) OPHTHALMOLOGICAL DEVICE

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To make an ophthalmological device photographable while aligning the photographing optical axis with the pupil center at all times even at the time of a peripheral photographing.

**SOLUTION:** A photographer operates a fixation target moving switch 30 while looking at a fundus image projected to a television monitor 6 and at a character K for indicating the position of a fixation target 23a presented to a subject and guides the line of sight of the subject so as to photograph a desired part. Images of alignment visual marks AL and AR illuminated by light sources 18L and 18R for visual mark illumination through optical fibers 17L and 17R are formed near an image pickup means 22, and alignment visual marks images AL' and AR' are displayed on the television monitor 76 together with the fundus image. The photographer operates a back-and-forth and left-and-right movement operation means 7 and a vertical movement switch 8 so as to overlap the alignment visual mark images AL' and AR' and aligning reference marks ML and MR moved by being linked with and position of the fixation target 23a displayed on the television monitor 6 and aligns an eye E to be tested with a main body optical system.



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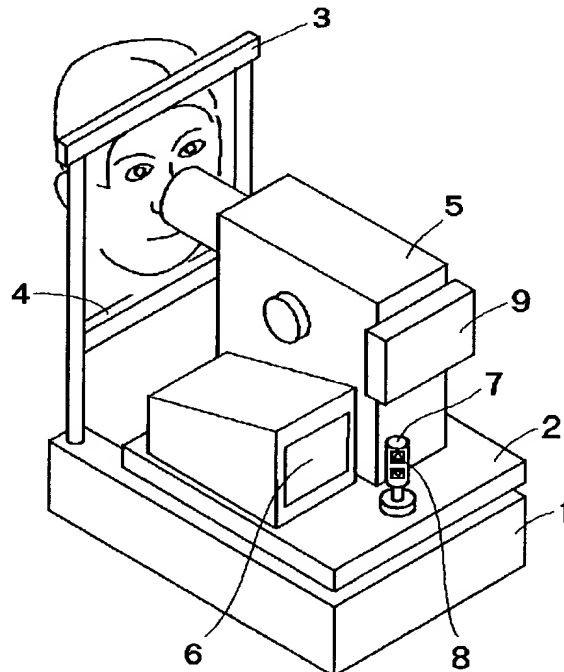
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(54) 【発明の名称】 眼科装置

(57) 【要約】

【課題】 周辺撮影の際にも常に撮影光軸が瞳孔中心を通るように位置合わせして撮影することができる。

【解決手段】 撮影者はテレビモニタ6に映し出された眼底像と被検者に呈示された固視目標23aの位置を示すキャラクタKを見ながら固視目標移動スイッチ30を操作して、所望の部位が撮影できるように被検者の視線を誘導する。視標照明用光源18L、18Rにより光ファイバ17L、17Rを介して照明されたアライメント視標AL、ARの像が、撮像手段22付近に結像し、眼底像と共にテレビモニタ6上にアライメント視標像AL'、AR'が表示される。撮影者はこのアライメント視標像AL'、AR'がテレビモニタ6上に表示された固視目標23aの位置に連動して移動する位置合わせ基準マークML、MRと重なるように、前後左右動操作手段7及び上下動スイッチ8を操作して、被検眼Eと本体光学系の位置合わせを行う。





## 【特許請求の範囲】

【請求項1】 被検者の視線を複数個所に誘導する固視目標提示手段と、被検眼の眼底像を観察する眼底観察手段と、被検眼の前眼部に視標光束を投影しその反射像を前記眼底観察手段に導く位置合わせ補助手段と、前記眼底観察手段に前記反射像を位置合わせする基準マークを前記固視目標提示手段に応じて異なる位置に表示する表示位置制御手段とを有することを特徴とする眼科装置。

【請求項2】 前記位置合わせ視標は複数の形状の異なる視標とし、前記基準マークの形状を前記位置合わせ視標の形状に対応させた請求項1に記載の眼科装置。

【請求項3】 前記位置合わせ視標は選択可能な複数の視標とし、前記基準マークを選択された前記位置合わせ視標に対応させて表示する請求項1に記載の眼科装置。

【請求項4】 被検者の視線を複数個所に誘導する固視目標提示手段と、被検眼の眼底像を撮像手段に導く撮像光学系と、前記眼底像を表示する表示手段よる成る眼底観察手段と、被検眼の前眼部に視標光束を投影しその反射像を前記撮像手段に導いて前記表示手段に表示する位置合わせ補助手段と、前記表示手段に前記反射像を位置合わせする基準マークを前記固視目標提示手段に応じて異なる位置に表示する表示位置制御手段とを有することを特徴とする眼科装置。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は、眼科医院等において使用する眼科装置に関するものである。

## 【0002】

【従来の技術】従来の眼底カメラにおいては、被検眼に視標光束を投影してその反射像を観察し、反射像位置を一定位置に合わせ、撮影光軸が瞳孔を通り被検眼と光学系が所定の距離を保つようにして位置合わせを行っている。

## 【0003】

【発明が解決しようとする課題】しかしながら上述の従来例においては、視神経乳頭を撮影範囲の中心に合わせて周辺部を撮影する場合には、見掛け上、瞳孔が小さくなる上に反射像の位置と瞳孔が偏心するために、撮影光軸が瞳孔の中心を通らないように位置合わせされてしまう。従って、瞳孔径の小さい被検眼では、照明光の片側が虹彩に遮ぎられ易くなるために、眼底を均一に照明することができない。特に、撮影光軸を瞳孔から左右に偏心させて位置合わせして立体撮影する場合には、左右の振り分け中心が瞳孔の中心と一致していないと、左右の画像で虹彩により遮ぎられる光量が異なるために照明光量に差が生じ、それらの画像を用いて立体視しても立体感が得難く、更にアライメントが適正位置からずれるためにフレアが発生するという問題点がある。

【0004】本発明の目的は、上述の問題点を解消し、周辺撮影の際にも常に撮影光軸が瞳孔中心を通るように

位置合わせを行う眼科装置を提供することにある。

## 【0005】

【課題を解決するための手段】上記目的を達成するための本発明に係る眼科装置は、被検者の視線を複数個所に誘導する固視目標提示手段と、被検眼の眼底像を観察する眼底観察手段と、被検眼の前眼部に視標光束を投影しその反射像を前記眼底観察手段に導く位置合わせ補助手段と、前記眼底観察手段に前記反射像を位置合わせする基準マークを前記固視目標提示手段に応じて異なる位置に表示する表示位置制御手段とを有することを特徴とする。

【0006】また、本発明に係る眼科装置は、被検者の視線を複数個所に誘導する固視目標提示手段と、被検眼の眼底像を撮像手段に導く撮像光学系と、前記眼底像を表示する表示手段よる成る眼底観察手段と、被検眼の前眼部に視標光束を投影しその反射像を前記撮像手段に導いて前記表示手段に表示する位置合わせ補助手段と、前記表示手段に前記反射像を位置合わせする基準マークを前記固視目標提示手段に応じて異なる位置に表示する表示位置制御手段とを有することを特徴とする。

## 【0007】

【発明の実施の形態】本発明を図示の実施例に基づいて詳細に説明する。図1は第1の実施例の眼底カメラの斜視図を示し、眼底カメラと被検眼との位置合わせをするために、赤外光を用いて被検眼を撮像してテレビモニタにより観察する無散瞳眼底カメラである。基台1上にはステージ2が三次元的に移動可能に載置されており、基台1の被検者側には顔を固定する額当て3及び顎受け4が固設されている。ステージ2上には光学系を内蔵する測定部筐体5、テレビモニタ6、前後左右動を行う操作手段7、上下動スイッチ8が配設されており、測定部筐体5にはデジタルカメラ9が取り付けられている。

【0008】図2は測定部の構成図を示し、測定部筐体5内において、被検眼Eに対向する対物レンズ11の後方の光路上に眼底撮影手段Aが構成されており、対物レンズ11側から、孔部に撮影絞り12aを有する孔あきミラー12、光路方向に移動してピントを調節するフォーカスレンズ13、撮影レンズ14、切換えミラー15が順次に配列され、マウント16を介して、撮影像面9aを有し画像メモリ9bを内蔵するデジタルカメラ9が装着されている。孔あきミラー12の孔部には、図3に示すように撮影絞り12a及び撮影絞り12aの両側に被検眼Eに投影する互いに異なる形状のアライメント視標AL、ARが設けられており、これらのアライメント視標AL、ARは光ファイバ17L、17Rを介して視標照明用光源18L、18Rに照明されるようになっており、これらの部材から位置合わせ補助手段Bが構成されている。

【0009】また、孔あきミラー12の入射方向には、赤外光を定常的に発し撮影時に可視閃光を発する既知の



眼底照明手段Cが配置されており、切換えミラー15の反射方向の光路上にはハーフミラー19が配設されている。ハーフミラー19の反射方向には眼底観察手段Dが構成されて、レンズ20、撮像レンズ21、撮像手段22が配列されており、ハーフミラー19の透過方向には、固視目標23aとして図4に示すような任意の透過領域を有する液晶素子23、バックライト24が配置されて、固視目標呈示手段Fが構成されている。

【0010】デジタルカメラ9と撮像手段22の出力は画像処理部25に接続され、画像処理部25の出力はテレビモニタ6に接続されている。また、バックライト24には液晶制御手段26の出力が接続され、液晶制御手段26にはCPU27の出力が接続されている。更に、CPU27の出力は制御手段28に接続され、制御手段28の出力は眼底照明手段C、切換えミラー15に接続されており、撮影モード選択スイッチ29、固視目標移動スイッチ30、撮影スイッチ31の出力がCPU27に接続されている。

【0011】このような構成において、撮影者は眼底撮影手段Aの光軸が被検眼Eの瞳孔Epの中心を通り、更に対物レンズ11と角膜Ecとが適正な距離を保つように、アライメント視標AL、ARの反射像を用いて本体光学系と被検眼Eとの位置合わせを行う。

【0012】即ち、被検者は顎台4に顎を載せ、額当て3に額を押し当てた状態で待機している。CPU27からの指令により、眼底照明手段Cは赤外光を発して眼底Erを定常的に照明する。このとき、制御手段28は視標照明用光源18L、18Rを点灯し、更に液晶制御手段26はバックライト24を点灯し、図4に示すように液晶素子23の予め決められたセルのみを透過状態にし、被検眼Eに固視目標23aを呈示する。

【0013】このように照明された眼底像は、瞳孔Ep、対物レンズ11、孔あきミラー12の孔部の撮影絞り12a、フォーカスレンズ13、撮影レンズ14を通り、切換えミラー15により下方に反射され、更にハーフミラー19により左方に反射され、レンズ20の付近に結像し、撮像レンズ21により撮像素子22付近に再結像する。この像は映像信号に変換され、画像処理部25によりテレビモニタ6に表示され、撮影者はこのテレビモニタ6に映った眼底像を観察し、撮影部位、フレアの有無、ピントの状態を確認する。

【0014】また、図5に示すように被検者に呈示している固視目標23aの位置を示すキャラクタKが、画像処理部25によって眼底像と合成されてテレビモニタ6に映し出される。撮影者はこの眼底像とキャラクタKを見ながら固視目標移動スイッチ30を操作して、所望の部位が撮影できるように被検者の視線を誘導する。

【0015】視標照明用光源18L、18Rにより光ファイバ17L、17Rを介して照明されたアライメント視標AL、ARの像は、対物レンズ11を通過して被検眼Eの

前眼部に投影され、角膜Ecで反射され、その反射像は対物レンズ11を通り、その後に眼底像と同様の経路を通過して、撮像手段22付近に結像し、眼底像と共にテレビモニタ6上にアライメント視標像AL'、AR'が表示される。

【0016】これらのアライメント視標像AL'、AR'は、被検者と本体光学系の位置合わせを補助するための視標なので、撮影者はこの反射像の輪郭が明瞭に見え、かつテレビモニタ6上に表示された固視目標23aの位置に連動して移動する位置合わせ基準マークML、MRと重なるように、前後左右動操作手段7及び上下動スイッチ8を操作して、被検眼Eと本体光学系の位置合わせを行う。

【0017】図5は被検眼Eの眼底の黄斑を中心にして撮影する場合のキャラクタK及び位置合わせ基準マークML、MRの配置を示し、キャラクタKは画面の中心に配置され、位置合わせ基準マークML、MRは上下方向の略中間の位置に略左右対称に配置されている。

【0018】また、図6は集団検診等で撮影する場合の撮影範囲を示し、視神経乳頭と黄斑を結ぶ線の間が画面の略中心に位置している。この場合には、キャラクタKは右方に偏心しており、位置合わせ基準マークML、MRもキャラクタKと同じ方向に偏心して表示されている。

【0019】更に、図7は視神経乳頭を画面の中心に配置して撮影する場合を示し、キャラクタKは右方向の端の方に位置しており、位置合わせ基準マークMRは図6の場合に比較して更に右方向に偏心して表示され、位置合わせ基準マークMLは表示範囲外であるために表示されていない。

【0020】図1は被検者の左眼を撮影する場合の配置を示しており、右眼を撮影する場合には乳頭と黄斑の位置が左右に入れ代えるために、キャラクタK及び位置合わせ基準マークML、MRは、図6と図7の場合と反対方向の左方向に偏心して表示される。

【0021】このような操作により、所望の撮影部位が得られて適正な位置合わせが終了した後に、撮影スイッチ31を操作して眼底Erを撮影する。検者が撮影スイッチ31を操作するとCPU27はこの入力を検知し、制御手段28は切換えミラー15を光路外に退避し、デジタルカメラ9が静止画撮影のための光蓄積を開始すると共に、眼底照明手段Cは可視の閃光を発する。この閃光は孔あきミラー12で反射され、対物レンズ11を通過した後に眼底Erを照明する。

【0022】このように照明された眼底像は、対物レンズ11、孔あきミラー12の孔の中の撮影絞り12a、フォーカスレンズ13、撮影レンズ14を通り、デジタルカメラ9の撮像面9aに結像する。この像はデジタル信号に変換され、デジタルカメラ9の画像メモリ9bに記憶されると共に、ビデオ信号に変換されてテレビモニタ6に再生され、撮影を終了する。なお、このときには





固視目標位置を示すキャラクタK及び位置合わせ基準マークML、MRは表示されない。

【0023】立体撮影を行う場合には、撮影モード選択スイッチ29を操作して立体撮影モードにする。このスイッチ操作に連動して、図8に示すように固視目標23aを示すキャラクタKは視神経乳頭が画面中心に位置するように呈示される。そして、視標照明用光源18Rのみが点灯し、アライメント視標ARの像のみが被検眼Eに投影され、位置合わせ基準マークMRのみがテレビモニタ6上の画像中心と固視目標呈示位置との偏心量の2/3〜3/4の位置に表示される。撮影者はアライメント視標ARの反射像を位置合わせ基準マークMRに合わせて、一対の立体画像の内の右画像の撮影を行う。

【0024】次に、テレビモニタ6には、位置合わせ基準マークMRを表示していた位置に図9に示すように位置合わせ基準マークMLが表示され、視標照明用光源18Rは消灯して視標照明用光源18Lのみが点灯する。撮影者はアライメント視標ALの反射像を位置合わせ基準マークMLに合わせて、一対の立体画像の内の左画像を撮影して立体撮影を終了する。

【0025】このように、撮影光軸を偏心させて立体撮影をする場合には、良好な画像を得るために通常よりも広い瞳孔径を必要とする。特に、乳頭を画面の中心に配置して撮影する周辺撮影の場合には、瞳孔Epが見掛け上小さくなるために、立体撮影の右画像の光軸と左画像の光軸を、瞳孔Epを中心としてより正確に振り分けて配置しなければならない。

【0026】本実施例による立体撮影においては、視標照明用光源18L、18Rを左右の撮影に応じて順次に点灯することにより、特にアライメント視標AL、ARの形状が同一の場合には、位置合わせ基準マークML、MRそれぞれに対応するアライメント視標AL、ARの反射像が明確になるので、効率の良い撮影を行うことができる。なお、任意の位置に視線を誘導する固視目標呈示手段について説明したが、左右眼又は撮影倍率に応じて固定した位置に固視目標23aを呈示する装置についても、位置合わせ基準マークML、MRを固視目標位置に応じて異なる位置に表示することにより、同様の効果を得ることができる。

【0027】図10は第2の実施例を示し、被検眼の観察を撮影者がファインダを通して肉眼で行う散瞳型の眼底カメラである。なお、第1の実施例と同一の符号は同一の部材を示している。第1の実施例における眼底撮影手段Aの切換えミラー15の位置に切換えミラー40が配置され、切換えミラー40の反射方向にハーフミラー41が配置されている。ハーフミラー41の左方反射方向には、フィールドレンズ42、ファインダレンズ43が配置されて、ファインダ光学系が構成されている。また、撮影者eから見てハーフミラー41の透過方向である右方反射方向には、レンズ44、ミラー45、第2の

液晶素子46、第2の液晶照明用手段47が順次に配列されて、基準視標投影光学系が構成されており、第2の液晶照明用手段47の出力は液晶制御手段26に接続されている。

【0028】眼底照明手段Cは定常的に可視光を発し、眼底Erはこの可視光により定常的に照明される。撮影者はこの定常光により照明された眼底Erと被検眼Eの角膜Ecからのアライメント用視標AL、ARの反射像を、ファインダ光学系を通して観察することができる。

【0029】第2の液晶素子46は液晶制御手段26により制御されており、第1の実施例と同様に基準視標形状の光透過部分を形成する。この基準マークML、MRは第2の液晶照明手段47により照明され、ミラー45で反射され、レンズ44によりフィールドレンズ付近に結像する。撮影者はファインダレンズ43により、この基準マークML、MRの像と眼底像更にアライメント視標AL、ARの反射像を重ねて観察することができる。

【0030】従って、撮影者eはファインダレンズ43を覗いて眼底像を観察しながら、アライメント視標AL、ARの反射像が、基準マークML、MRに合致するように位置合わせすることにより、第1の実施例と同様の効果を得ることができる。なお、第2の実施例では2つの液晶表示手段を用いたが、1つの液晶表示手段を部分的に被検者への固視目標投影用と、撮影者への基準マークML、MR投影用とに使い分けてもよい。

【0031】

【発明の効果】以上説明したように本発明に係る眼科装置は、眼底像を観察しながら視標光束の反射像が基準マークに合致するように位置合わせを行うことにより、被検眼の周辺撮影をする場合でも、正確に撮影光軸を瞳孔の中心に位置することが可能となり、更に瞳孔の中心に対して正確に撮影光軸を振り分けて位置合わせができるので、小さい瞳孔径の被検眼に対しても、光量差の少ない左右の立体像が撮影でき、良好な立体感を有する撮影画像を得ることができる。

【0032】また、本発明に係る眼科装置は、位置合わせするための基準マークを固視目標位置に対応して異なる位置に表示し、その位置に被検眼の前眼部に投影した視標光束の反射像を一致させて位置合わせを行うことにより、被検眼の周辺撮影をする場合でも、正確に撮影光軸を瞳孔の中心に位置することが可能となり、更に瞳孔の中心に対して正確に撮影光軸を振り分けて位置合わせができるので、小さい瞳孔径の被検眼に対しても、光量差の少ない左右の立体像が撮影でき、良好な立体感を有する撮影画像を得ることができる。

【図面の簡単な説明】

【図1】第1の実施例の眼底カメラの斜視図である。

【図2】構成図である。

【図3】補助視標の正面図である。

【図4】固視目標の説明図である。



【図5】黄斑を中心に撮影する場合の表示画面の説明図である。

【図6】集団検診時の表示画面の説明図である。

【図7】視神経乳頭を中心にした場合の表示画面の説明図である。

【図8】立体撮影時の右表示画面の説明図である。

【図9】左表示画面の説明図である。

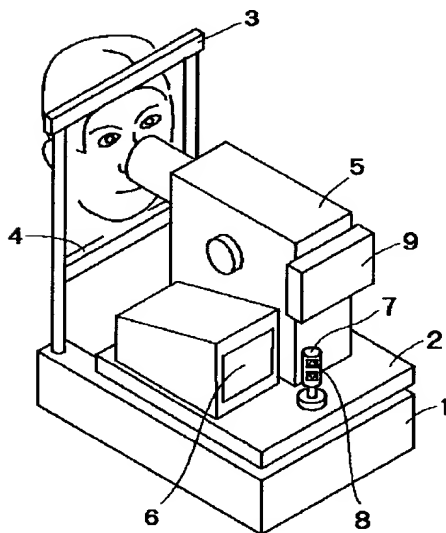
【図10】第2の実施例の眼底カメラの構成図である。

【符号の説明】

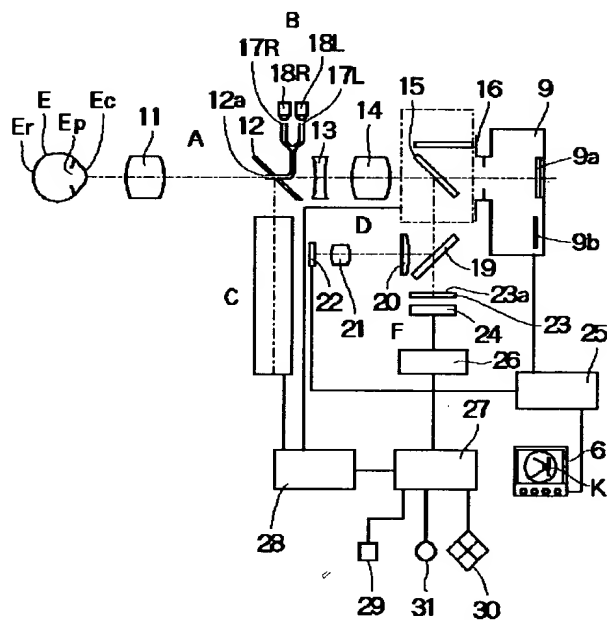
- 1 基台  
5 測定部筐体  
6 テレビモニタ  
7 操作手段  
8 上下動スイッチ  
9 デジタルカメラ

- 12 孔あきミラー  
12a 撮影絞り  
15 切換えミラー  
17L、17R 光ファイバ  
18L、18R 視標照明用光源  
22 撮像手段  
23 液晶素子  
25 画像処理部  
26 液晶制御手段  
27 CPU  
28 制御手段  
29 撮影モード選択スイッチ  
30 固視目標移動スイッチ  
31 撮影スイッチ

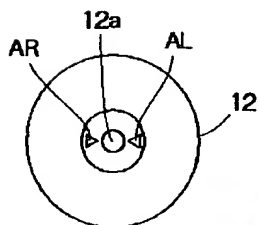
【図1】



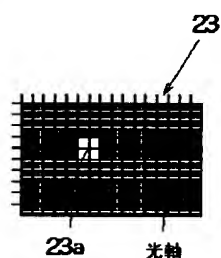
【図2】



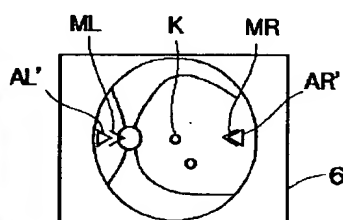
【図3】



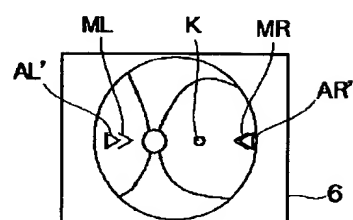
【図4】



【図5】

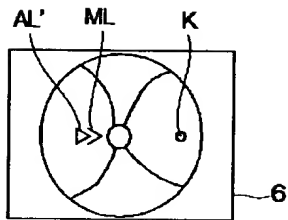


【図6】

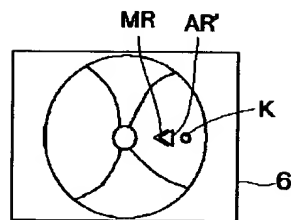




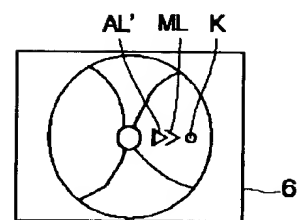
【図7】



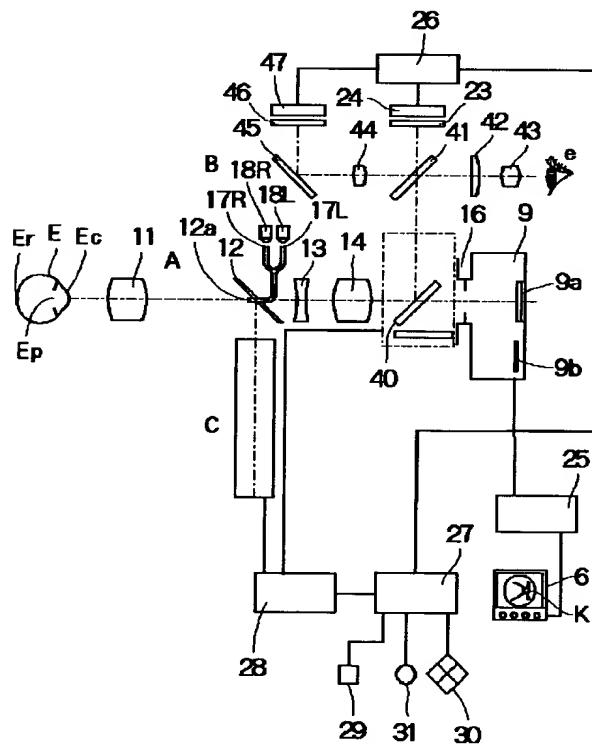
【図8】



【図9】



【図10】





# PATENT ABSTRACTS OF JAPAN

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**A61B 3/14**

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(71)Applicant : **CANON INC**

(22)Date of filing : **01.05.1998**

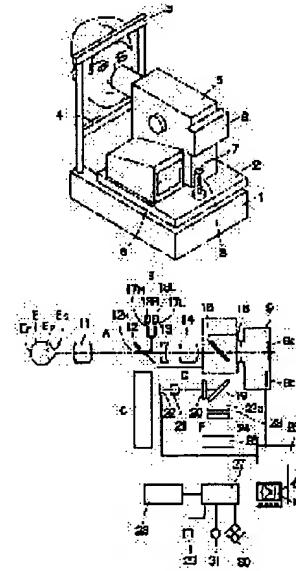
(72)Inventor : **MATSUMOTO KAZUHIRO**

## (54) OPHTHALMOLOGICAL DEVICE

### (57)Abstract:

PROBLEM TO BE SOLVED: To make an ophthalmological device photographable while aligning the photographing optical axis with the pupil center at all times even at the time of a peripheral photographing.

SOLUTION: A photographer operates a fixation target moving switch 30 while looking at a fundus image projected to a television monitor 6 and at a character K for indicating the position of a fixation target 23a presented to a subject and guides the line of sight of the subject so as to photograph a desired part. Images of alignment visual marks AL and AR illuminated by light sources 18L and 18R for visual mark illumination through optical fibers 17L and 17R are formed near an image pickup means 22, and alignment visual marks images AL' and AR' are displayed on the television monitor 76 together with the fundus image. The photographer operates a back-and-forth and left-and-right movement operation means 7 and a vertical movement switch 8 so as to overlap the alignment visual mark images AL' and AR' and aligning reference marks ML and MR moved by being linked with and position of the fixation target 23a displayed on the television monitor 6 and aligns an eye E to be tested with a main body optical system.



## LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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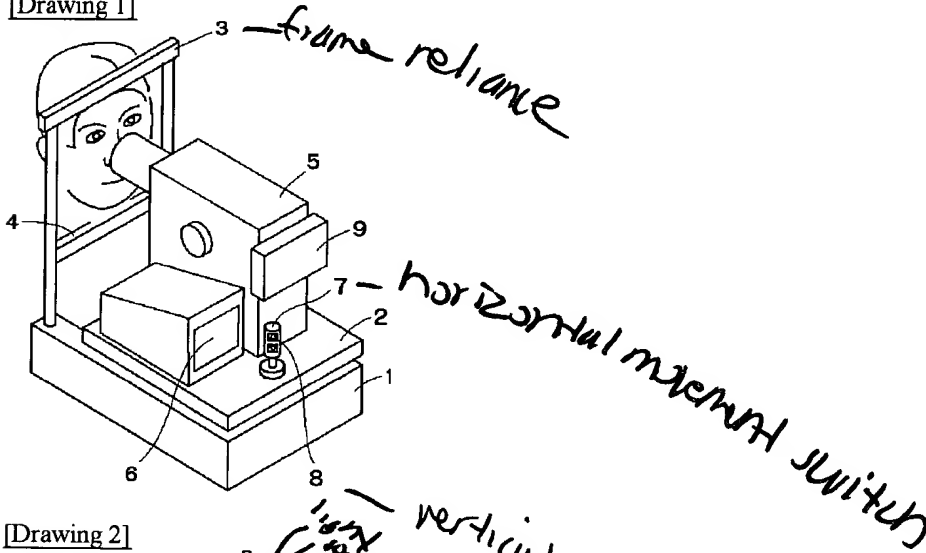
\* NOTICES \*

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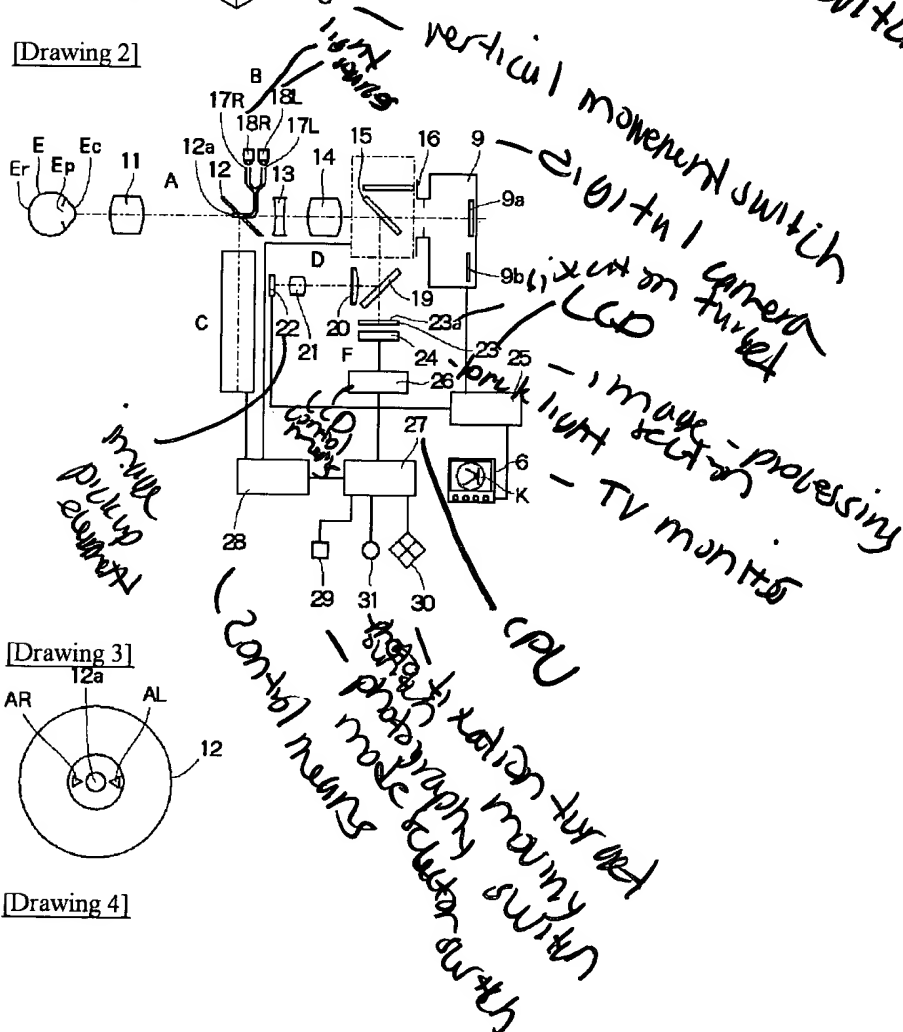
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## DRAWINGS

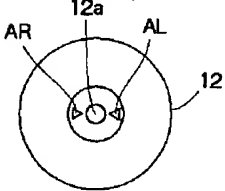
[Drawing 1]



[Drawing 2]

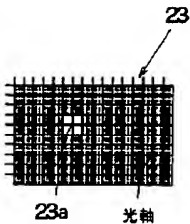


[Drawing 3]

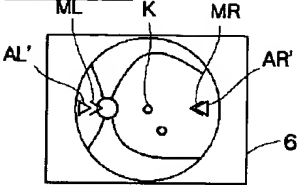


[Drawing 4]

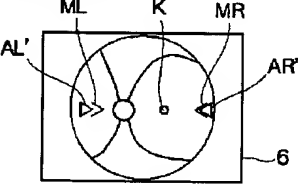




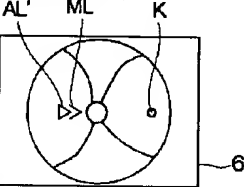
[Drawing 5]



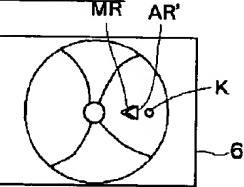
[Drawing 6]



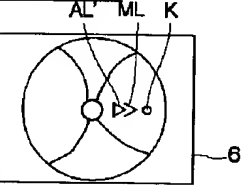
[Drawing 7]



[Drawing 8]

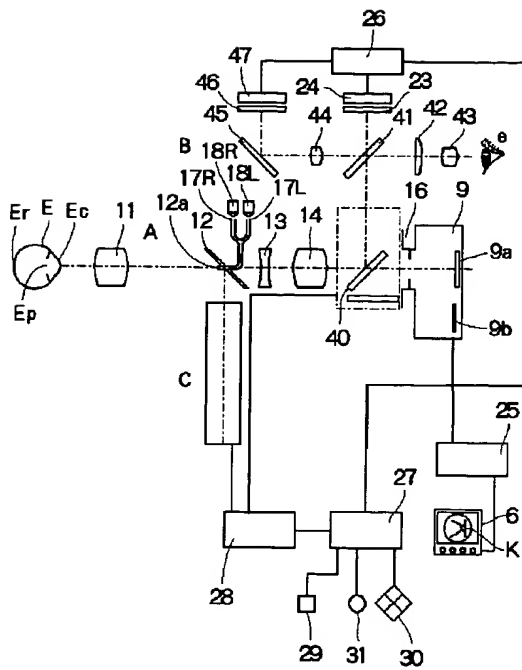


[Drawing 9]



[Drawing 10]





[Translation done.]



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**DESCRIPTION OF DRAWINGS**

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[Brief Description of the Drawings]

[Drawing 1] It is the perspective diagram of the fundus camera of the 1st example.

[Drawing 2] It is a block diagram.

[Drawing 3] It is the front view of an auxiliary target.

[Drawing 4] It is explanatory drawing of a fixation target.

[Drawing 5] It is explanatory drawing of the display screen in the case of taking a photograph focusing on a macula lutea.

[Drawing 6] It is explanatory drawing of the display screen at the time of a mass screening.

[Drawing 7] It is explanatory drawing of the display screen at the time of centering on the optic disk.

[Drawing 8] It is explanatory drawing of the right display screen at the time of stereoradiography.

[Drawing 9] It is explanatory drawing of the left display screen.

[Drawing 10] It is the block diagram of the fundus camera of the 2nd example.

[Description of Notations]

- 1 Pedestal
- 5 Test-Section Case
- 6 Television Monitor
- 7 Operation Means
- 8 Vertical-Movement Switch
- 9 Digital Camera
- 12 Hole -- Vacancy Mirror
- 12a Photography drawing
- 15 Change Mirror
- 17L, 17R Optical fiber
- 18L, 18R The light source for target lighting
- 22 Image Pick-up Means
- 23 Liquid Crystal Device
- 25 Image-Processing Section
- 26 Liquid Crystal Control Means
- 27 CPU
- 28 Control Means
- 29 Photography Mode Selection Switch
- 30 Fixation Target Move Switch
- 31 Photography Switch

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[Translation done.]





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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the ophthalmology equipment used in an ophthalmology hospital etc.

[0002]

[Description of the Prior Art] In the conventional fundus camera, as project the target flux of light on optometry-ed, the reflected image is observed, a reflected image position is doubled with a fixed position and a photography optical axis maintains a distance predetermined in optometry-ed and optical system through a pupil, alignment is performed.

[0003]

[Problem(s) to be Solved by the Invention] However, in the above-mentioned conventional example, in doubling the optic disk with the center of the photography range and photoing a periphery, in order that a pupil may turn small up seemingly and the position and pupil of a reflected image may carry out eccentricity, alignment will be carried out so that a photography optical axis may not pass along the center of a pupil. Therefore, in small optometry-ed of a pupil diameter, since one side of lighting light \*\*\*\*\*-comes to be easy to the iris, eyegrounds cannot be illuminated uniformly. If the distribution center on either side is not in agreement with the center of a pupil when eccentricity of the photography optical axis is carried out to right and left, it carries out alignment from a pupil and carries out stereoradiography especially, since the \*\*\*\*\* quantity of light changes with iris by the picture on either side, even if a difference arises in the lighting quantity of light and it carries out stereoscopic vision using those pictures, a cubic effect is difficult to get, and since alignment shifts from a proper position further, there is a trouble that the flare is generated.

[0004] The purpose of this invention cancels an above-mentioned trouble, and is to offer the ophthalmology equipment which performs alignment so that a photography optical axis may always pass along a pupil center also in the case of circumference photography.

[0005]

[Means for Solving the Problem] The ophthalmology equipment concerning this invention for attaining the above-mentioned purpose A fixation target presentation means to guide the visual axis of the subject to two or more places, and an eyegrounds observation means to observe the eyegrounds image examined the eyes, It is characterized by having the alignment auxiliary means which project the target flux of light on front \*\*\*\* examined the eyes, and lead the reflected image to the aforementioned eyegrounds observation means, and the display-position control means which display the reference mark which carries out alignment of the aforementioned reflected image to the aforementioned eyegrounds observation means on a different position according to the aforementioned fixation target presentation means.

[0006] Moreover, a fixation target presentation means by which the ophthalmology equipment concerning this invention guides the visual axis of the subject to two or more places, The image pck-up optical system which leads the eyegrounds image examined the eyes to an image pck-up means, and a display means \*\*\*\*\* eyegrounds observation means to display the aforementioned eyegrounds image, The alignment auxiliary means which project the target flux of light on front \*\*\*\* examined the eyes, lead the reflected image to the aforementioned image pck-up means, and are displayed on the aforementioned display means, It is characterized by having the display-position control means which display the reference mark which carries out alignment of the aforementioned reflected image to the aforementioned display means on a different position according to the aforementioned fixation target presentation means.

[0007]

[Embodiments of the Invention] this invention is explained in detail based on the example of illustration. Drawing 1 is a non-mydrasis fundus camera which uses infrared light, picturizes optometry-ed and is observed by the television monitor, in order to show the perspective diagram of the fundus camera of the 1st example and to carry out alignment of a fundus camera and optometry-ed. On the pedestal 1, the stage 2 is laid possible [ movement ] in three dimensions, and the frame reliance 3 and the jaw receptacle 4 which fix a face are fixed to the subject side of a pedestal 1. On the stage 2, the test-section case 5 which builds in optical system, the television monitor 6, an operation means 7 to perform order horizontal movement, and the vertical-movement switch 8 are arranged, and the digital camera 9 is attached in the test-section case 5.

[0008] Drawing 2 shows the block diagram of a test section, and the eyegrounds photography means A is constituted on the optical path behind the objective lens 11 which counters the optometry E-ed in the test-section case 5. The focal lens 13 and



taking lens 14 which move in the vacancy mirror 12 and the direction of an optical path, and adjust a focus, and the change mirror 15 are arranged one by one, and mounting 16 is minded. the hole which has photography drawing 12a in a pore from an objective lens 11 side -- It is equipped with the digital camera 9 which has photography image surface 9a and contains image-memory 9b. a hole -- as shown in drawing 3, the alignment targets AL and AR of a mutually different configuration projected on the optometry E-ed are formed in the pore of the vacancy mirror 12 at the both sides of photography drawing 12a and photography drawing 12a, these alignment targets AL and AR are illuminated through optical fibers 17L and 17R by the light sources 18L and 18R for target lighting, and the alignment auxiliary means B consist of these members

[0009] moreover, a hole -- in the direction of incidence of the vacancy mirror 12, the known eyegrounds lighting means C which emits infrared light regularly and emits a visible flash at the time of photography is arranged, and the one-way mirror 19 is arranged on the optical path of the reflective direction of the change mirror 15 The eyegrounds observation means D is constituted in the reflective direction of a one-way mirror 19, the lens 20, the image pck-up lens 21, and the image pck-up means 22 are arranged, in the transparency direction of a one-way mirror 19, the liquid crystal device 23 and back light 24 which have arbitrary transparency fields as shown in drawing 4 as fixation target 23a are arranged, and the fixation target presentation means F is constituted.

[0010] The output of a digital camera 9 and the image pck-up means 22 is connected to the image-processing section 25, and the output of the image-processing section 25 is connected to the television monitor 6. Moreover, the output of the liquid crystal control means 26 is connected to a back light 24, and the output of CPU27 is connected to the liquid crystal control means 26. Furthermore, the output of CPU27 is connected to control means 28, the output of control means 28 is connected to the eyegrounds lighting means C and the change mirror 15, and the output of the photography mode selection switch 29, the fixation target move switch 30, and the photography switch 31 is connected to CPU27.

[0011] In such composition, a photography person performs alignment of main part optical system and the optometry E-ed using the reflected image of the alignment targets AL and AR so that the optical axis of the eyegrounds photography means A may pass along the center of the pupil Ep examined [ E ] the eyes and may maintain distance with still more proper objective lens 11 and Cornea Ec.

[0012] That is, the subject puts a jaw on \*\*\*\* 4, and where a frame is pressed against the frame reliance 3, it is standing by. By the instructions from CPU27, the eyegrounds lighting means C emits infrared light, and illuminates Eyegrounds Er regularly. At this time, further, control means 28 turn on the light sources 18L and 18R for target lighting, and the liquid crystal control means 26 turn on a back light 24, as shown in drawing 4, they change into a transparency state only the cell the liquid crystal device 23 was beforehand decided to be, and they show fixation target 23a to the optometry E-ed.

[0013] thus, the illuminated eyegrounds image -- Pupil Ep, an objective lens 11, and a hole -- photography drawing 12a of the pore of the vacancy mirror 12, the focal lens 13, and a taking lens 14 -- a passage -- the change mirror 15 -- caudad -- reflecting -- having -- further -- a one-way mirror 19 -- a left -- reflecting -- having -- a lens 20 -- image formation is carried out near and re-image formation is carried out to the image pck-up element 22 neighborhood by the taking lens 21 This image is changed into a video signal and it is displayed on a television monitor 6 by the image-processing section 25, and a photography person observes the eyegrounds image reflected in this television monitor 6, and checks a photography part, the existence of the flare, and the state of a focus.

[0014] Moreover, the character K which shows the position of fixation target 23a shown to the subject as shown in drawing 5 is compounded by the image-processing section 25 with an eyegrounds image, and projects on a television monitor 6 by it. A photography person operates the fixation target move switch 30, looking at this eyegrounds image and character K, and he guides the visual axis of the subject so that a desired part can be photoed.

[0015] The image of the alignment targets AL and AR illuminated through optical fibers 17L and 17R with the light sources 18L and 18R for target lighting It is projected on front \*\*\*\* examined [ E ] the eyes through an objective lens 11, and is reflected by Cornea Ec. The reflected image passes along an objective lens 11, passes along the same path as an eyegrounds image after that, it carries out image formation to the image pck-up means 22 neighborhood, and alignment target image AL' and AR' are displayed on a television monitor 6 with an eyegrounds image.

[0016] Since it is a target these alignment target image AL' and for AR' assisting the alignment of the subject and main part optical system, a photography person operates the order horizontal movement operation means 7 and the vertical-movement switch 8, and performs alignment of the optometry E-ed and main part optical system so that it may lap with the alignment reference marks ML and MR which interlock and move to the position of fixation target 23a where the profile of this reflected image looked clear, and was displayed on the television monitor 6.

[0017] Drawing 5 shows arrangement of the character K in the case of taking a photograph focusing on the macula lutea of eyegrounds examined [ E ] the eyes, and the alignment reference marks ML and MR, a character K is arranged at the center of a screen and the alignment reference marks ML and MR are arranged in the position of abbreviation middle of the vertical direction at the abbreviation bilateral symmetry.

[0018] Moreover, drawing 6 shows the photography range in the case of taking a photograph by the mass screening etc., and the middle of a line which connects the optic disk and a macula lutea is located focusing on the abbreviation for a screen. In this case, eccentricity of the character K is carried out to the method of the right, eccentricity of it is carried out in the direction as a character K where the alignment reference marks ML and MR are also the same, and it is displayed on it.

[0019] Furthermore, drawing 7 shows the case where the optic disk is arranged and photoed at the center of a screen, the character K is located in the direction of a rightward edge, and as compared with the case of drawing 6, further, eccentricity of the



alignment reference mark MR is carried out rightward, it is displayed on it, and since the alignment reference mark ML is outside a display rectangle, it is not displayed.

[0020] Drawing 1 shows the arrangement in the case of photoing the left eye of the subject, in photoing a right eye, in order that the position of a papilla and a macula lutea may put in and replace with right and left, eccentricity of a character K and the alignment reference marks ML and MR is carried out drawing 6, the case of drawing 7, and leftward [ of opposite direction ], and they are displayed on them.

[0021] After a desired photography part is obtained by such operation and proper alignment is completed, the photography switch 31 is operated and Eyegrounds Er are photoed. If a \*\* person operates the photography switch 31, CPU27 detects this input, and while control means 28 evacuate the change mirror 15 out of an optical path and starting the optical accumulation for still picture photography of a digital camera 9, the eyegrounds lighting means C will emit a visible flash. this flash -- a hole -- it is reflected by the vacancy mirror 12, and Eyegrounds Er are illuminated after passing along an objective lens 11

[0022] thus, the illuminated eyegrounds image -- an objective lens 11 and a hole -- photography drawing 12a in the hole of the vacancy mirror 12, the focal lens 13, and a taking lens 14 -- a passage -- a digital camera 9 -- image formation is carried out to image pck-up side 9a It is changed into a video signal, a television monitor 6 is reproduced, and this image ends photography while it is changed into a digital signal and memorized by image-memory 9b of a digital camera 9. In addition, at this time, the character K which shows a fixation target position, and the alignment reference marks ML and MR are not displayed.

[0023] In performing stereoradiography, the photography mode selection switch 29 is operated and it makes it stereoradiography mode. This switch operation is interlocked with, and the character K which shows fixation target 23a as shown in drawing 8 is shown so that the optic disk may be located centering on a screen. And only light source 18R for target lighting lights up, only the image of the alignment target AR is projected on the optometry E-ed, and only the alignment reference mark MR is displayed on the position of  $2/3 - 3/4$  of the eccentricity of the picture center on a television monitor 6, and a fixation target presentation position. A photography person doubles the reflected image of the alignment target AR with the alignment reference mark MR, and photos the right picture of the stereogram images of a couple.

[0024] Next, as shown in the position which showed the alignment reference mark MR at drawing 9, the alignment reference mark ML is displayed on a television monitor 6, light source 18R for target lighting puts out the light, and only light source 18L for target lighting turns it on. A photography person doubles the reflected image of the alignment target AL with the alignment reference mark ML, photos the left picture of the stereogram images of a couple, and ends stereoradiography.

[0025] Thus, in carrying out eccentricity of the photography optical axis and carrying out stereoradiography, in order to acquire a good picture, it needs a latus pupil diameter rather than usual. In the circumference photography which arranges and photos a papilla at the center of a screen especially, since Pupil Ep becomes small seemingly, focusing on Pupil Ep, the optical axis of the right picture of stereoradiography and the optical axis of a left picture must be distributed more to accuracy, and must be arranged.

[0026] In the stereoradiography by this example, since the reflected image of the alignment reference mark ML and the alignment targets AL and AR corresponding to each MR becomes clear by switching on the light one by one according to photography of right and left of the light sources 18L and 18R for target lighting when especially the configuration of the alignment targets AL and AR is the same, efficient photography can be performed. In addition, although a fixation target presentation means to guide a visual axis to arbitrary positions was explained, the same effect can be acquired by displaying the alignment reference marks ML and MR on a different position according to a fixation target position also about the equipment which shows fixation target 23a to the position fixed according to the right-and-left eye or the photography scale factor.

[0027] Drawing 10 is a mydriasis type fundus camera to which the 2nd example is shown and a photography person performs observation examined the eyes through a finder with the naked eye. In addition, the same sign as the 1st example shows the same member. It switches to the position of the change mirror 15 of the eyegrounds photography means A in the 1st example, a mirror 40 is arranged, and the one-way mirror 41 is arranged in the reflective direction of the change mirror 40. In the left reflective direction of a one-way mirror 41, the field lens 42 and the finder lens 43 are arranged, and finder optical system is constituted. Moreover, it sees from the photography person e, and in the method of right reflective direction which is the transparency direction of a one-way mirror 41, a lens 44, a mirror 45, the 2nd liquid crystal device 46, and the 2nd means 47 for liquid crystal lighting are arranged one by one, the criteria target projection optical system is constituted, and the output of the 2nd means 47 for liquid crystal lighting is connected to the liquid crystal control means 26.

[0028] The eyegrounds lighting means C emits the light regularly, and Eyegrounds Er are regularly illuminated by this light. A photography person can observe the reflected image of the targets AL and AR for alignment from the cornea Ec examined [ the eyegrounds Er illuminated by this fixed light and / E ] the eyes through finder optical system.

[0029] The 2nd liquid crystal device 46 is controlled by the liquid crystal control means 26, and forms the light-transmission portion of a criteria target configuration like the 1st example. It is illuminated by the 2nd liquid crystal lighting means 47, and is reflected by the mirror 45, and image formation of these reference marks ML and MR is carried out near a field lens with a lens 44. With the finder lens 43, a photography person can observe the image of these reference marks ML and MR, an eyegrounds image, and also the reflected image of the alignment targets AL and AR in piles.

[0030] Therefore, peeping into the finder lens 43 and observing an eyegrounds image, the photography person e can acquire the same effect as the 1st example, when the reflected image of the alignment targets AL and AR carries out alignment so that it may agree in reference marks ML and MR. In addition, although two liquid crystal display meanses were used in the 2nd example, you may use one liquid crystal display means properly partially to the object for the fixation target projection to the subject, and the



reference mark ML to a photography person and the object for MR projection.

[0031]

[Effect of the Invention] The ophthalmology equipment applied to this invention as explained above By performing alignment so that the reflected image of the target flux of light may agree in a reference mark, observing an eyegrounds image Since it becomes possible to locate a photography optical axis at the center of a pupil correctly, a photography optical axis is correctly distributed further to the center of a pupil and alignment is made even when carrying out circumference photography examined the eyes Also to optometry-ed of a small pupil diameter, the stereoscopic model of few right and left of a quantity of light difference can be photoed, and the photography picture which has a good cubic effect can be acquired.

[0032] Moreover, by the ophthalmology equipment concerning this invention displaying the reference mark for carrying out alignment on a different position corresponding to a fixation target position, making in agreement the reflected image of the target flux of light projected on the position at front \*\*\*\* examined the eyes, and performing alignment Since it becomes possible to locate a photography optical axis at the center of a pupil correctly, a photography optical axis is correctly distributed further to the center of a pupil and alignment is made even when carrying out circumference photography examined the eyes Also to optometry-ed of a small pupil diameter, the stereoscopic model of few right and left of a quantity of light difference can be photoed, and the photography picture which has a good cubic effect can be acquired.

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[Translation done.]





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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

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CLAIMS

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[Claim(s)]

[Claim 1] Ophthalmology equipment characterized by providing the following. A \*\*\*\* target presentation means to guide a \*\*-ed person's look to two or more places. A fundus-of-the-eye observation means to observe the fundus-of-the-eye image examined the eyes. Alignment auxiliary means which project the target flux of light on front \*\*\*\* examined the eyes, and lead the reflected image to the aforementioned fundus-of-the-eye observation means. Display-position control means which display the reference mark which carries out alignment of the aforementioned reflected image to the aforementioned fundus-of-the-eye observation means on a different position according to the aforementioned \*\*\*\* target presentation means.

[Claim 2] The aforementioned alignment target is ophthalmology equipment according to claim 1 which it considered equipment ] as the target with which two or more configurations differ, and made the configuration of the aforementioned reference mark equivalent to the configuration of the aforementioned alignment target.

[Claim 3] The aforementioned alignment target is ophthalmology equipment according to claim 1 which consider as two or more selectable targets, and the aforementioned alignment target which had the aforementioned reference mark chosen is made to correspond, and is displayed.

[Claim 4] Ophthalmology equipment characterized by providing the following. A \*\*\*\* target presentation means to guide a \*\*-ed person's look to two or more places. Image pck-up optical system which leads the fundus-of-the-eye image examined the eyes to an image pck-up means. A display means \*\*\*\*\* fundus-of-the-eye observation means to display the aforementioned fundus-of-the-eye image. Alignment auxiliary means which project the target flux of light on front \*\*\*\* examined the eyes, lead the reflected image to the aforementioned image pck-up means, and are displayed on the aforementioned display means, and display-position control means which display the reference mark which carries out alignment of the aforementioned reflected image to the aforementioned display means on a different position according to the aforementioned \*\*\*\* target presentation means.

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[Translation done.]

